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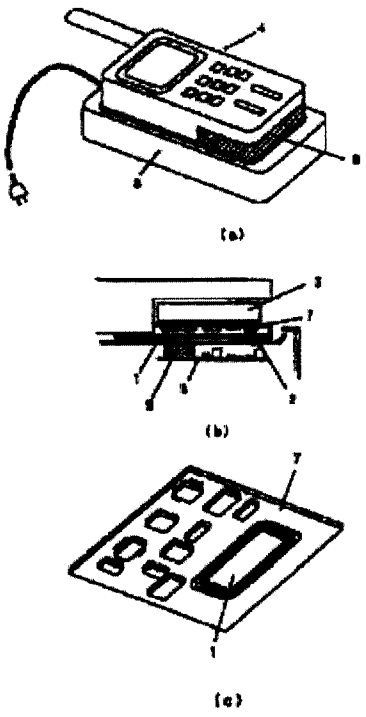
(54) NON-CONTACT TYPE BATTERY CHARGER

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a battery charger capable of fully realizing the performance of a secondary battery and also capable of building compact, thin, lightweight, high-reliability electronic devices using chargeable secondary batteries as power sources.
SOLUTION: In an electronic equipment having a charge type secondary battery 3 charging power by energy transmission from charging side to the side to be charged by means of magnetic induction, a circuit 2 at the side of power charging, and a built-in power receiving coil, a substrate 7 made of magnetic materials is arranged, which is built in the electronic equipment and formed with a power receiving coil 1 and a circuit 2 at the side to be charged, between the secondary battery side 9 and a power transmitting coil at the charging side in a state where the electronic equipment is provided at the charging side of the equipment.



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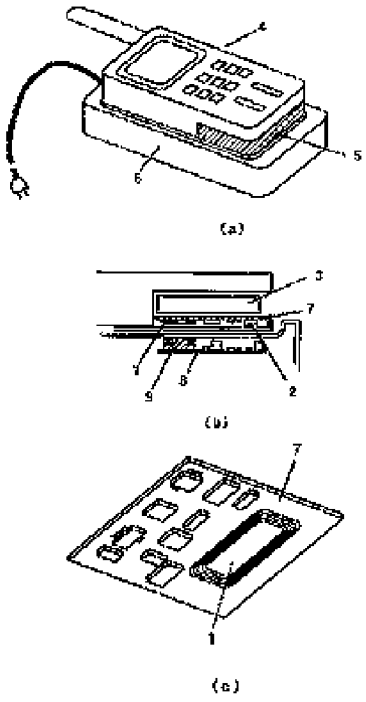
(54)【発明の名称】　非接触型充電装置

(57)【要約】
【課題】充電可能な２次電池を電源とする電子機器において小形、薄型、かつ軽量であり信頼性が高い電子機器構築することを可能とし、さらに２次電池の性能を充分発揮させることのできる非接触型充電装置を提供することを目的とする。
【解決手段】磁気誘導を利用して充電側から被充電側へエネルギー伝送する非接触型充電装置を介して充電される充電式の２次電池と前記被充電側の回路および受電コイルを内蔵する電子機器において、前記非接触型充電装置のうち充電側に電子機器を設置した状態における充電側の送電コイルと前記２次電池との間に、前記電子機器に内蔵され、被充電側の回路および受電コイルを構成した磁性材からなる基板を配置する。



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【特許請求の範囲】

【請求項１】電磁誘導を利用して充電側から被充電側へエネルギー伝送する非接触型充電装置を介して充電される充電式の２次電池と前記被充電側の回路および受電コイルを内蔵する電子機器において、

前記電子機器に内蔵され、被充電側の回路および受電コイルを構成した磁性材からなる基板を、前記２次電池と、

前記非接触型充電装置に電子機器を設置した状態における充電側の送電コイルとの間に、配置したことを特徴とする非接触型充電装置。

【請求項２】被充電側の回路および受電コイルを構成した磁性材からなる前記基板が、熱硬化性または熱可塑性の樹脂にフェライト粉末またはアモルファス磁性粉末を混合し成型した板からなることを特徴とする請求項１記載の非接触型充電装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、コードレス電話機、携帯用機器等の電源として利用される充電式電池を、電磁誘導作用により充電部から被充電部へ金属接点を介さず非接触で電力を電送するための電磁誘導コイルを使用した充電器であって、コードレス電話機、携帯用機器等に組み込まれている電磁誘導装置に関する。

【０００２】

【従来の技術】コードレス電話、ＰＨＳ、携帯電話、トランシーバー等、充電可能な２次電池を電源とする電子機器、特に携帯用機器は小形、薄型、軽量化の要求を受ける。また、一方では動作時間をできるだけ長くするための改善が望まれている。

【０００３】これらの相反する要求を満足するため、電子機器に使用される２次電池には小形、軽量であり長寿命のＬｉイオン電池等が採用されている。しかし、これらの電池は温度上昇等に起因する発煙等の問題があり安全性を確保するため、充電器や電源回路を設計する場合には過放電や過充電に充分な注意を払わなければならない。

【０００４】特にＬｉイオン電池はその性能を充分に発揮させるため、充電電圧の電圧公差を±２０ｍＶ／ｃｅｌ以内に設定しなければならないばかりか、過電圧が加わった場合には金属Ｌｉが析出するという問題があるため、設計には精度の高い定電流、定電圧制御が必要である。しかし、２次電池を充電する充電装置は電子機器と充電装置の間に電極による接点が存在するため、その接触抵抗によって２次電池にかかる充電電圧が変化し、電池両端の電圧情報が充電装置に正確に伝達されず、接触抵抗による電圧降下のばらつきを考慮しなければならないため、電池両端に充分な充電電圧をかけることができず、公称充電容量の６０乃至７０％しか充電することができなかった。

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【０００５】そこで、充電装置と電子機器の間に接点が存在せず、安定した充電電圧を２次電池に供給することができる電磁誘導を利用した非接触型充電装置が前記２次電池の充電に使われるようになった。

【０００６】しかし、さらなる小形、薄型、軽量化の要求が電子機器にたいして改善が望まれている。

【０００７】

【発明が解決しようとする課題】コードレス電話、ＰＨＳ、携帯電話、トランシーバー等、充電可能な２次電池を電源とする電子機器、特に携帯用機器にたいする市場要求は小形、薄型、軽量であって、かつ動作時間が長いことである。

【０００８】これらの要求に対応するため高効率の２次電池であるＮｉ水素電池、Ｌｉイオン電池等が採用されてきたが、電池の性能を充分生かすため充電装置の更なる改善が望まれている。

【０００９】本発明は、充電可能な２次電池を電源とする電子機器において小形、薄型、かつ軽量であり信頼性が高い電子機器構築することを可能とし、さらに２次電池の性能を充分発揮させることのできる非接触型充電装置を提供することを目的とする。

【００１０】

【課題を解決するための手段】上記目的を達成するために本発明は、磁気誘導を利用して充電側から被充電側へエネルギー伝送する非接触型充電装置を介して充電される充電式の２次電池と前記被充電側の回路および受電コイルを内蔵する電子機器において、前記２次電池と前記非接触型充電装置のうち充電側に電子機器を設置した状態における充電側の送電コイルとの間に、前記電子機器に内蔵され、被充電側の回路および受電コイルを構成した磁性材からなる基板を配置する非接触型充電装置を提供する。

【００１１】さらに本発明は、被充電側の回路および受電コイルを構成した磁性材からなる前記基板が、熱硬化性または熱可塑性の樹脂にフェライト粉末またはアモルファス磁性粉末を混合し成型した板からなることによって、さらに非接触型充電装置の被充電側を内蔵する電子機器の信頼性を上げることができる。

【００１２】

【発明の実施の形態】電子機器に内蔵される非接触充電装置の被充電側回路および受電コイルと２次電池は図１に示すようなブロック図で示されるように、非接触充電装置の充電側から電磁誘導によって伝送されるエネルギーを受電コイル１で受け被充電側回路２を経由して２次電池３を充電する構成となる。

【００１３】このような電子機器の構造を図２に示す。（ａ）はその構造図、（ｂ）はその断面図、（ｃ）は基板の概念図である。

【００１４】電子機器４を充電する場合（ａ）に示すように非接触充電装置の充電側６に電子機器４を搭載す

る。そのとき、非接触充電装置の被充電側５は非接触充電装置の充電側６と近接するように置かれる。

【００１５】この場合、（ｂ）の断面図に示されるように、非接触充電装置の充電側６には電磁誘導により非接触でエネルギーを伝送するための制御回路と送電コイル９等を搭載した送電用基板８が配置され、電子機器側には非接触充電装置の被充電側回路２および受電コイル１とを搭載した基板７が前記非接触でエネルギーを伝送するための制御回路等を搭載した送電用基板８と対向する位置に配置されている。さらに、非接触充電装置の被充電側回路２および受電コイルと１を搭載した基板７の背面には２次電池３が配置されている。

【００１６】非接触充電装置の被充電側回路２および受電コイル１とを搭載した基板７は（ｃ）の基板概念図に示されているように受電コイル１が搭載される。受電コイル１は薄型の空芯コイルを基板７に接着したものであっても良く、基板７上に導電体をスパイラル状に印刷したものであっても良いが、部品や受電コイル１を搭載した状態で表面実装技術等を用いできるだけ薄く作成することにより、受電コイル１を前記制御回路等を搭載した送電用基板８と近接させることが可能となり、かつ背面に２次電池３を配置しても電子機器４の薄型という特徴を損ねることがない。

【００１７】さらに、受電コイル１とを搭載した基板７を磁性材によって構成することによって充電側と２次電池をシールドすることによって、充電側より伝送されるエネルギーが基板背面に位置する２次電池３に達することによって発生する渦電流損をなくすことが可能となり、さらには渦電流による２次電池３の加熱に起因する

事故を、より容易に防止することが可能となり信頼性の向上につながる。

【００１８】ここで、受電コイル１とを搭載した基板７を、熱硬化性または熱可塑性の樹脂にフェライト粉末またはアモルファス磁性粉末を混合し成型した板を使用すれば、容易に成型、加工することが可能であり絶縁性も良いため、製造性も良く信頼性も高い。

【００１９】基板７の比透磁率が高いほど受電コイル１で受けるエネルギーは大きくなり、フェライト粉末を使用すれば、基板７の比透磁率を１０程度までですることが可能となり、アモルファス磁性粉末を使用すれば８０程度まで上げることが可能となる。

【００２０】

【発明の効果】本発明により、充電可能な２次電池を電源とする電子機器において小形、薄型、かつ軽量であり信頼性が高い電子機器構築することを可能とし、さらに２次電池の性能を充分発揮させることのできる非接触型充電装置を提供することができる。

【図面の簡単な説明】

【図１】非接触型充電装置における被充電側のブロック図

【図２】非接触型充電装置の被充電側を内蔵した電子機器の構造図

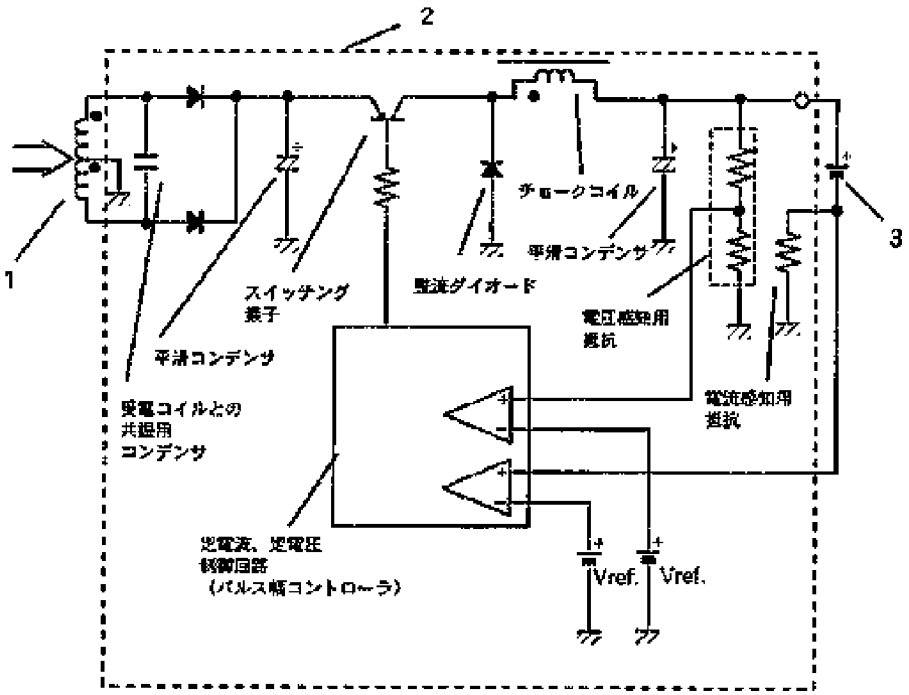
【符号の説明】

１　受電コイル

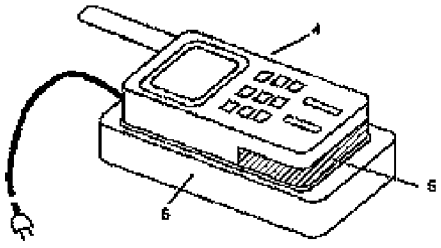
３　２次電池

７　非接触充電装置の被充電側回路２および受電コイルと１を搭載した基板

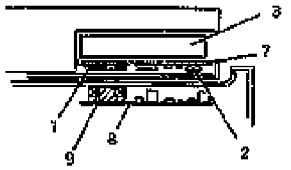
【図１】


2
1
3
チョークコイル
平滑コンデンサ
スイッチング
素子
整流ダイオード
電圧感知用
抵抗
平滑コンデンサ
受電コイルとの
共振用
コンデンサ
電流感知用
抵抗
定電流、定電圧
制御回路
（パルス幅コントローラ）
Vref.
Vref.

【図2】



(a)



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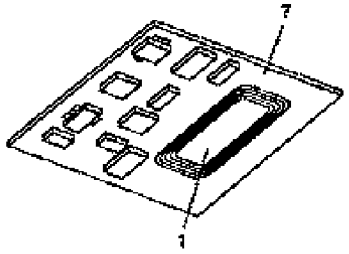

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H04M 1/02			H04M 1/02	C	

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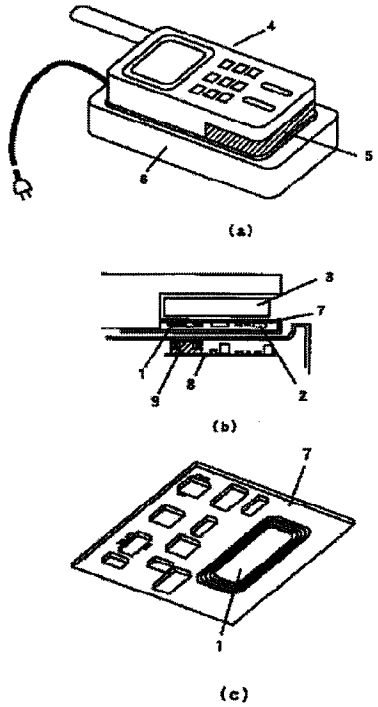
(54) Title of the Invention: Non-Contact Type Battery Charger

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a non-contact type battery charger capable of fully realizing the performance of a secondary battery and also capable of building compact, thin, lightweight, highly-reliable electronic devices using rechargeable secondary batteries as power supplies.

SOLUTION: An electronic device having a rechargeable secondary battery which is recharged by electromagnetic induction from the charging side to the charged side by means of energy transmitted by non-contact type charging apparatus and which has a circuit and power-receiving coil on the charged side thereof, which further has a substrate made of magnetic material built into the electronic device and comprising a power receiving coil and a charged side circuit, and which is disposed between the power transmitting coil on the charging side and the secondary battery in the condition wherein the electronic device is disposed on the charging side of the apparatus.



Claims

Claim 1 An electronic device having a rechargeable secondary battery which is recharged by electromagnetic induction from the charging side to the charged side by means of energy transmitted by non-contact type charging apparatus and which has a circuit and power-receiving coil on the charged side thereof,

wherein the non-contact type battery charger has a substrate made of magnetic material built into the electronic device and comprising a power receiving coil and a circuit on the charged side and which is disposed between the secondary battery

and the power transmitting coil on the charging side and the secondary battery in the condition wherein the electronic device is disposed on the charging side of the apparatus.

Claim 2

The substrate made of magnetic material comprising a power receiving coil and a circuit on the charged side of the non-contact type battery charger recited in Claim 1 is a substrate formed of a mixture of ferrite powder or amorphous magnetic powder in thermosetting or thermoplastic resin.

Detailed Description of the Invention

0001

Technology Field of the Invention

This invention pertains to electromagnetic induction apparatus serving as battery chargers using electromagnetic induction coils which use the electromagnetic induction effect to transmit electric power in a noncontacting fashion from a power charging part to a part to be charged without passing through metallic contacts in cordless telephones, portable telephones, and other such devices which use rechargeable batteries as their power source and which are built into cordless telephones, portable telephones, and other such devices.

0002

Prior Art

Small sizes, slimmer profiles, and lighter weights are called for in electronic devices and particularly in portable devices such as cordless telephones, PHS, portable telephones, walkie-talkies, and the like which have as their power supply rechargeable secondary batteries. On the other hand, however, improvements to extend their operating times are desirable, as well.

0003

To meet these competing requirements, lithium-ion batteries which are small in size and light in weight and which have long service lives are used for the secondary batteries used in these electronic devices. However, these batteries have the problem that they can emit smoke and the like due to increased temperature, etc., and adequate attention must be paid to over discharging and overcharging in the design of their power receiving parts and power supply circuits to ensure their safety.

0004

In particular, not only must the charging voltage be set within a voltage margin of ± 20 mV/cell to obtain lithium ion battery performance, but designs characterized by high precision constant current and voltage control are necessary to deal with the issue of metallic lithium deposition when overvoltage to the battery is applied. Nevertheless, the charging voltage applied to the secondary battery varies because of contact resistance due to the presence of electrode contact points between the electronic device and the recharging apparatus which recharges the secondary batteries thereof. Consequently, voltage information between the battery terminals is not transmitted correctly to the charging apparatus and, since it is necessary to take into consideration variations in the voltage drop due to contact resistance, sufficient charging voltage cannot be applied to the terminals of the battery, and only 60-70% of the rated charging capacity can be charged.

0005

Thus, non-contact type battery chargers which do not have contact points between the charging apparatus and electronic device and which use electromagnetic induction which can supply the secondary battery with stable charging voltage have been used.

0006

However, further improvements in relation to the demands for electronic devices that are smaller in size, slimmer in profile, and lighter in weight.

0007

Problems the Invention Seeks to Resolve

Small size, slim profile, and light weight, as well as longer operating times are called for in electronic devices and particularly in portable devices such as cordless telephones, PHS, portable telephones, walkie-talkies, and the like which have as their power supply rechargeable secondary batteries.

0008

Although high-efficiency secondary batteries such as nickel metal hydride batteries, lithium ion batteries, and the like have been used to meet these requirements, further improvements in battery charging apparatus are desirable to make fullest use of the performance of these batteries.

0009

It is therefore an objective of the present invention to provide a non-contact type battery charger capable of fully realizing the performance of a secondary battery and also capable of building compact, thin, lightweight, highly-reliable electronic devices using rechargeable secondary batteries as power sources.

0010

Means of Solving the Problems

To achieve these objectives, the present invention provides a non-contact type battery charger which is an electronic device having a rechargeable secondary battery which is recharged by electromagnetic induction from the charging side to the charged side by means of energy transmitted by non-contact type charging apparatus and which has a cir-

cuit and power-receiving coil on the charged side thereof, wherein the non-contact type battery charger has a substrate made of magnetic material built into the electronic device and comprising a power receiving coil and a circuit on the charged side and which is disposed between the secondary battery, and the power transmitting coil on the charging side and the secondary battery in the condition wherein the electronic device is disposed on the charging side of the apparatus.

0011

Moreover, the present invention can achieve further improvements in the reliability of electronic devices provided internally with a charged side of the non-contact type battery charger by having a substrate made of magnetic material comprising a power receiving coil and a circuit on the charged side which is a substrate formed of a mixture of ferrite powder or amorphous magnetic powder in thermosetting or thermoplastic resin.

0012

Embodiments of the Invention

As shown in the block diagram in Fig. 1, the charged side circuit of a non-contact battery charger housed in an electronic device and a power-receiving coil and secondary battery are so constituted that the energy transmitted by electromagnetic induction from the charging side of the non-contact battery charger is received by the power receiving coil 1 and charges the secondary battery 3 via the charged side circuit 2.

0013

Fig. 2 illustrates the structure of this type of electronic device. (a) is a structural drawing, (b) is a cross-sectional view, and (c) is a schematic diagram of the substrate.

0014

The electronic device 4 which is recharged as shown in (a) is an electronic device 4 which has a non-contact battery charger charging side 6 installed therein. Thus, the charged side 5 of the non-contact battery charger is placed in close proximity with the non-contact battery charger charging side 6.

0015

In this case, as illustrated in the cross-sectional view (b), the charging side 6 of the non-contact battery charger has a power transmission substrate 8 which is provided with a control circuit, power transmission coil 9, and the like to transmit energy in non-contact fashion by means of electromagnetic induction, while the electronic device side has a substrate 7 which is provided with a charged side circuit 2 of the non-contact battery charger and a power receiving coil 1 which are disposed so as to oppose one another. Moreover, a secondary battery 3 is disposed on the rear surface of the substrate 7 which is provided with the charged side circuit 2 of the non-contact battery charger and power receiving coil 1.

0016

As illustrated in the schematic view of the substrate in (c), the substrate 7 which is provided with a charged side circuit 2 of the non-contact battery charger and a power re-

ceiving coil 1 has a power receiving coil 1 installed therein. The power receiving coil 1 may consists of a thin hollow core coil bonded to the substrate 7, or may be printed as a spiral-shaped conductor upon the substrate 7, but the power receiving coil 1 can be placed in proximity to the power transmitting substrate 8 which is provided with the control circuit and the like therein by fabricating the parts and power receiving coil 1 as thinly as possible through the use of surface mounting technology or the like, and furthermore, the characteristically slim profile of the electronic device 4 will not be compromised even when the secondary battery 3 is disposed on the rear surface thereof.

0017

Furthermore, by forming the substrate 7, which is provided with a power receiving coil 1 therein, of magnetic material, the charging side and secondary battery are therefore shielded so that the energy transmitted from the charging side reaches the secondary battery 3, which is positioned on the rear face of the substrate, so that the eddy current loss generated can be eliminated. Moreover, malfunctions caused by heat generated by the secondary battery 3 due to eddy current can more easily be prevented and reliability improved thereby.

0018

In this embodiment, the substrate which is provided with a power receiving coil 1 therein is a panel formed of a mixture of ferrite powder or amorphous magnetic powder in thermosetting or thermoplastic resin which can be easily formed and machined, and which has excellent insulating and structural properties, and therefore affords high reliability.

0019

The higher the relative permeability of the substrate 7, the greater the energy received by the power receiving coil 1. When ferrite powder is used, the relative permeability of the substrate 7 can be as high as approximately 10 while the use of amorphous magnetic powder can raise relative permeability to approximately 80.

0020

Effect of the Invention

By means of the present invention, it is possible to build highly reliable electronic devices which use rechargeable secondary batteries as their power supply that are small in size, slim in profile, and low in weight. Moreover, a non-contact type battery charger can be provided which can fully realize the formants of secondary batteries.

Brief Description of the Drawings

Fig. 1 Block diagram of the charged side in a non-contact type battery charger

Fig. 2 Structural drawing of an electronic device provided with a built-in charged side of a non-contact type battery charger

Symbols

1 Power receiving coil

3 Secondary battery

7 Charged side circuit 2 and substrate provided with a power receiving coil 1 of a non-contact battery charger

Fig. 1

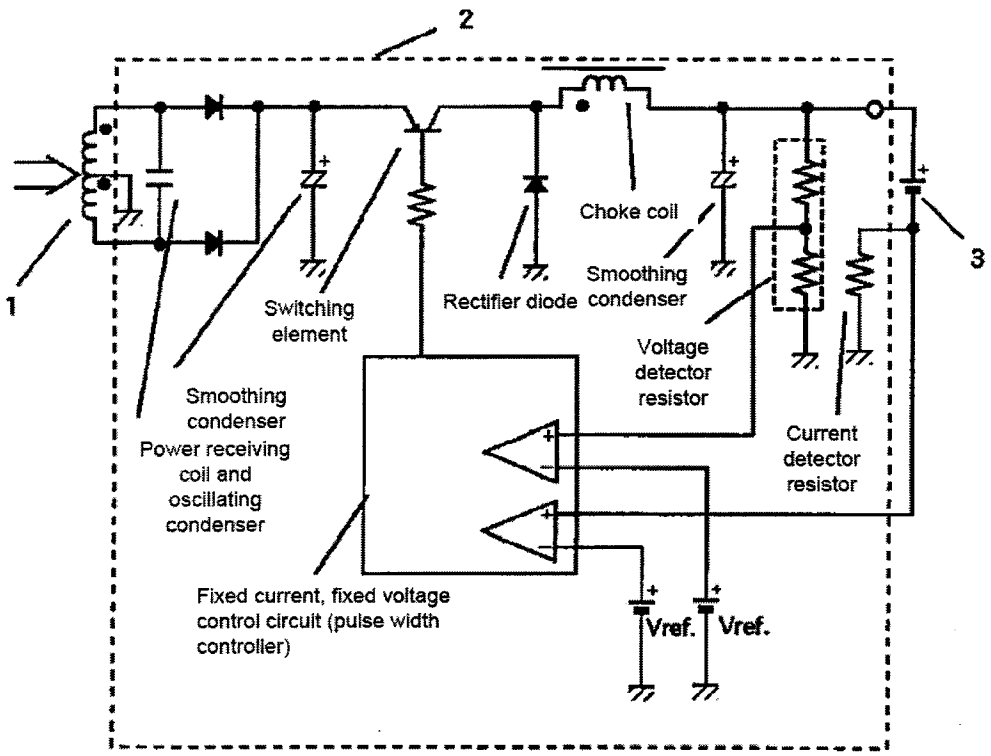

2
1
3
Choke coil
Smoothing condenser
Rectifier diode
Switching element
Voltage detector resistor
Smoothing condenser
Power receiving coil and oscillating condenser
Current detector resistor
Fixed current, fixed voltage control circuit (pulse width controller)
Vref.
Vref.

Fig. 2